

ECON 165, Section # 1

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Logistics

- ▶ danicara@stanford.edu
- ▶ OH Wed 9.30-11.30am
- ▶ Section Fri 10.30-12.30pm
- ▶ Email to cover something you didn't understand specific in section.
- ▶ Watch **pre-recorded videos** during the week (before Friday sections)
- ▶ Also, attend:
 - assigned live section with Luigi,
 - OH as needed,
 - study buddy

→ Questions?

Plan for today

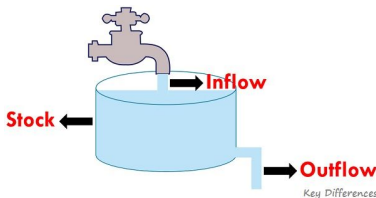
- ▶ Balance of Payments Review + practice
- ▶ Solving models + practice

Note: for simplicity take the United States as the country of reference.

Getting the Jargon Right: NIIP

NIIP: *Net International Investment Position.*

- ▶ Definition?
 - Net foreign wealth, i.e. the value of all foreign wealth the US owns *minus* the value of all US wealth owned by the rest of the world.
- ▶ Is it a stock or a flow?
 - A stock!



- ▶ How to change NIIP?

Getting the Jargon Right: Current Account

CA: *Current Account*.

- ▶ This is (part) of what makes the NIIP move: it is the flow of goods, services, and income. The US can have a deficit in the current account only if other countries lend to it (e.g. give them a car), in turn lowering the US NIIP.
- ▶ Definition?
 - Exports and imports of goods and services and international receipts or payments of income.
- ▶ What else affects the NIIP?

NIIP changes and CA: what's the difference? Valuation!

- ▶ US starts with NIIP of -\$100 in year 2000.
 - Owns 25 shares of FIAT which are worth €2 each.
 - China has \$150 worth of US bonds.
 - ▶ In 2000 the \$/€ exchange rate is 1. In 2001, the US buys or sells nothing and the FIAT stock is still worth €2 but the \$/€ exchange rate falls to 0.5. What is the US' 2001 NIIP in \$'s?
- -\$125

Getting the Jargon Right: Financial Account

- ▶ The financial equivalent of the Current Account: no longer goods, services, and income but financial assets (e.g. bonds, stocks, currency).
- ▶ What is double entry book-keeping?
 - Every credit (+), i.e. outflow of value appears alongside a debit (-), i.e. inflow of value.

Examples

Describe how the US balance of payments is affected in these examples:

- ▶ An American gives an Italian \$100 worth of jeans and gets \$100 worth of pasta in return.

Account	+	-
Current	\$100 of jeans	\$100 of pasta
Financial		

Examples

Describe how the US balance of payments is affected in these examples:

- ▶ An Italian firm buys \$5 million worth of US corporate bonds.

Account	+	-
Current		
Financial	\$5mil cash	\$5mil corporate bonds

Accounting Identities

$$Y = C + I + G + \underbrace{NX}_{\text{Exports} - \text{Imports}}$$

- ▶ What is each of the terms?
- ▶ Y : Income earned in the US
- ▶ $C + I + G + NX$: Expenditure.
- What you spend becomes someone else's income.

Accounting Identities Speed Round

- ▶ Where does the \$ spent on your education go? $\rightarrow C$
- ▶ What about the money a Consulting firm spends to send a worker to get an MBA? $\rightarrow I \longrightarrow$ investment in human capital by firm
- ▶ What is in G ?
 - Does buying a new aircraft belong to G ? Yes!
 - Does taxing the rich and giving that money to the poor belong to G ? No!
- ▶ Why is trade good?

Models and Economics

What I cannot create [cf. model], I do not understand

Richard Feynman, Nobel Prize in Physics

1. World is complicated \rightarrow need a *model* to simplify and study it.
 - simplified (models always miss things)
 - + rigorous and have tools to work and solve them

2. Models' building blocks are:
 - parameters: fixed numbers (e.g. discount factor β)
 - exogenous variable: unaffected by the actions of agents in the economy.
We can think of them as being determined by nature.
 - endogenous variable: variables that are chosen directly or are affected by the decisions of the model's decision makers

Optimization Review, pg. 1

- ▶ Objective function \rightarrow e.g. lifetime utility,
- ▶ Choice variables \rightarrow e.g. consumption and savings
- ▶ Constraints \rightarrow e.g. budget constraint
- ▶ Extra conditions \rightarrow e.g. no-Ponzi + transversality

$$\begin{array}{ll}\max_{C_1, C_2, B_1, B_2} & U(C_1, C_2) \\ \text{s.t.} & C_1 + B_1 \leq Q_1 + B_0(1 + r_1) \\ & C_2 + B_2 \leq Q_2 + B_1(1 + r_2) \\ & B_2 \geq 0 \quad B_2 \leq 0\end{array}$$

Optimization Review, pg. 2

$$\begin{array}{ll}\max_{C_1, C_2, B_1, B_2} & U(C_1, C_2) \\ \text{s.t.} & C_1 + B_1 \leq Q_1 + B_0(1 + r_0) \\ & C_2 + B_2 \leq Q_2 + B_1(1 + r_1), \\ & B_2 \geq 0, \quad B_2 \leq 0\end{array}$$

1. Sort out No-Ponzi and transversality $\Rightarrow B_2 = 0$
2. Consolidate and bind budget constraint $\Rightarrow C_1 + \frac{C_2}{1+r_1} = Q_1 + \frac{Q_2}{1+r_1} + B_0$
3. Substitute away $\Rightarrow C_2 = (1 + r_1) \left[(1 + r_0)B_0 + Q_1 + \frac{Q_2}{1+r_1} - C_1 \right]$
4. Take derivatives (i.e. first order conditions)

Optimization Review, pg. 3

$$\max_{C_1} U \left(C_1, (1 + r_1) \left[(1 + r_0)B_0 + Q_1 + \frac{Q_2}{1 + r_1} - C_1 \right] \right)$$

C_1 :

$$\frac{\partial U}{\partial C_1} = 0$$

5. From first-order condition get C_1 ,
6. From intertemporal budget constraint get C_2 ,
7. From individual budget constraints get B_1 and B_2 .

Intertemporal Problem: 3-period problem

Output in periods $t = 1, 2, 3$ is Q_1, Q_2, Q_3 , respectively. Net foreign wealth at $t = 0$ is B_0^* . The lifetime utility function is

$$U(C_1, C_2, C_3) = \ln(C_1) + \ln(C_2) + \ln(C_3).$$

1. Write the household's budget constraint in periods 1, 2, and 3.
2. Write the no-Ponzi and transversality constraints.
3. Derive the intertemporal budget constraint.
4. Compute the equilibrium levels of consumption, the trade balance, and the current account in periods 1, 2, and 3.

Intertemporal Problem: 3-period problem

Solution (1.): Write the household's budget constraint in periods 1, 2, and 3.

$$\begin{array}{rcl} \text{EXPENDITURES:} & & \text{RESOURCES:} \\ C_1 + B_1 & \leq & (1+r_0)B_0^* + Q_1 \\ C_2 + B_2 & \leq & (1+r_1)B_1 + Q_2 \\ C_3 + B_3 & \leq & (1+r_2)B_2 + Q_3 \end{array}$$

Intertemporal Problem: 3-period problem

Solution (2.): Write the no-Ponzi and transversality constraints.

$B_3 \geq 0 \longrightarrow$ NO PONZI (cannot leave debt left-over)
 $B_3 \leq 0 \longrightarrow$ TRANSVERSALITY (don't allow to leave anything on the table)

$$\Rightarrow B_3 \underline{\underline{=}} 0$$

Intertemporal Problem: 3-period problem

Solution (3.): Derive the intertemporal budget constraint.

Substitute B_1 from $t=1$ budget into t_2 budget
 B_2 from t_2 budget into b_3 budget

$$\Rightarrow C_3 + B_3 = B_0^* (1+r_0)(1+r_1)(1+r_2) + (1+r_1)(1+r_2)(Q_1 - C_1) + (1+r_2)(Q_2 - C_2) + Q_3$$

Note L_t 's are all expenditures & R_t 's all resources left over in period $t=3$ (after you've eaten C_1 and C_2)

Intertemporal Problem: 3-period problem

a little algebra gives: $C_1 = \frac{1}{3} \left[(1+r_0) B_0^* + Q_1 + \frac{Q_2}{1+r_1} + \frac{Q_3}{(1+r_1)(1+r_2)} \right]$

$$C_2 = \frac{1}{3} \left[(1+r_0)(1+r_1) B_0^* + (1+r_1) Q_1 + Q_2 + \frac{Q_3}{1+r_2} \right]$$

Solution (4.): Compute the equilibrium levels of consumption, the trade balance, and the current account in periods 1, 2, and 3.

$$\begin{aligned} \max_{C_1, C_2, C_3} \quad & \ln(C_1) + \ln(C_2) + \ln(C_3) \\ \text{s.t.} \quad & C_3 = (1+r_0)(1+r_1)(1+r_2) B_0^* + (1+r_1)(1+r_2)(Q_1 - C_1) \\ & \quad + (1+r_2)(Q_2 - C_2) + Q_3 \end{aligned}$$

recall we established $B_3 = 0$ using NO-PONZI \hookrightarrow TRANSVERSALITY

one rewrite problem as:

$$\max_{C_1, C_2} \ln(C_1) + \ln(C_2) + \ln \left(\frac{(1+r_0)(1+r_1)(1+r_2) B_0^* + (1+r_1)(1+r_2)(Q_1 - C_1) + (1+r_2)(Q_2 - C_2) + Q_3}{(1+r_0)(1+r_1)(1+r_2) B_0^* + (1+r_1)(1+r_2)(Q_1 - C_1) + (1+r_2)(Q_2 - C_2) + Q_3} \right)$$

FOC:
[C1]

$$\frac{1}{C_1} = \frac{(1+r_1)(1+r_2)}{(1+r_0)(1+r_1)(1+r_2) B_0^* + (1+r_1)(1+r_2)(Q_1 - C_1) + (1+r_2)(Q_2 - C_2) + Q_3}$$

[C2]

$$\frac{1}{C_2} = \frac{(1+r_2)}{(1+r_0)(1+r_1)(1+r_2) B_0^* + (1+r_1)(1+r_2)(Q_1 - C_1) + (1+r_2)(Q_2 - C_2) + Q_3}$$